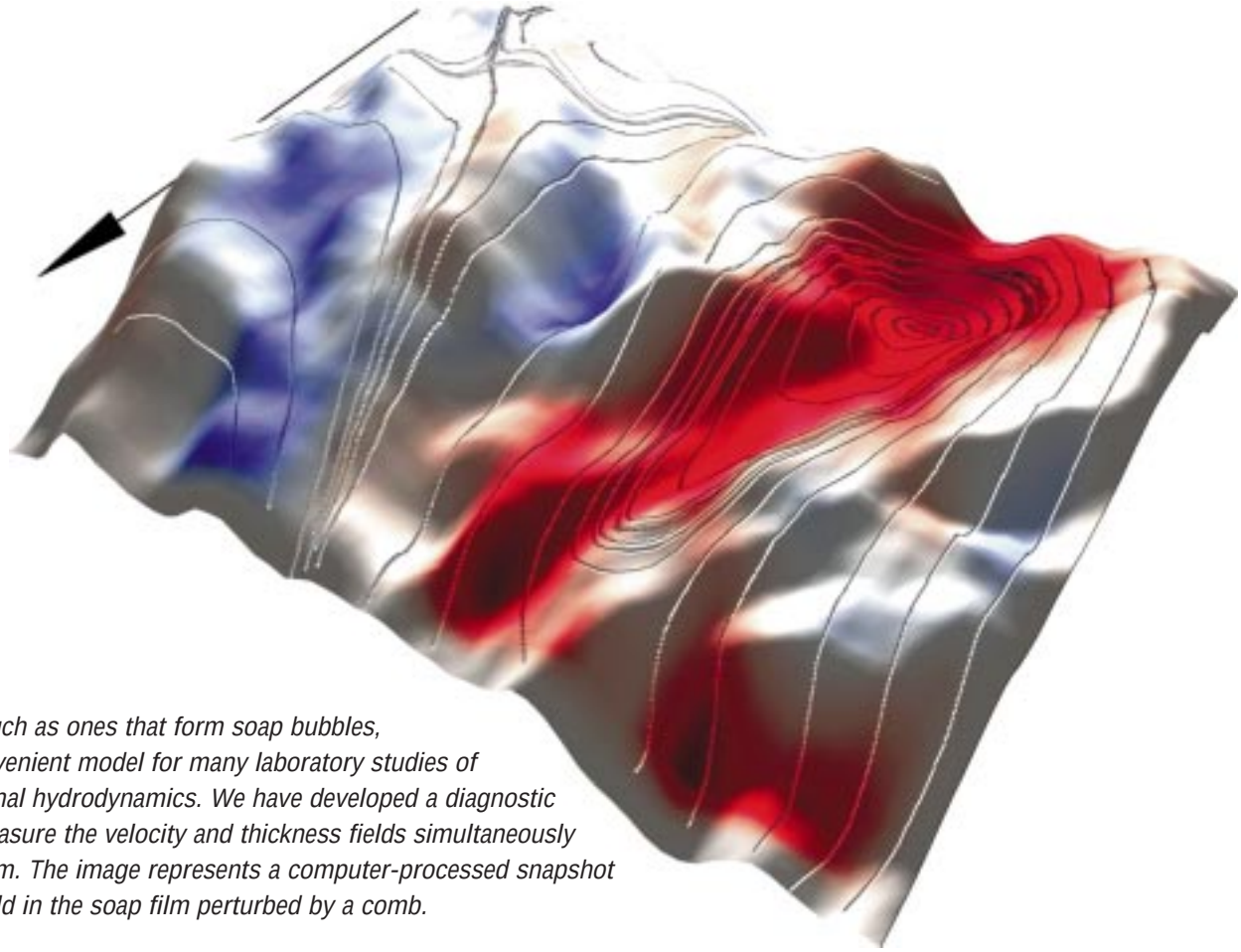
Transition Period for BITS
BITS will be published bimonthly for the remainder of 1998. This change occurs because the managing editor of BITS is leaving the Laboratory, and CIC management would like to take this opportunity to reevaluate the communication objectives of the publication before a new managing editor is assigned.

BITS computing&communications news

August-September 1998

COMPUTING, INFORMATION, AND COMMUNICATIONS (CIC) DIVISION • LOS ALAMOS NATIONAL LABORATORY



Soap films, such as ones that form soap bubbles, present a convenient model for many laboratory studies of two-dimensional hydrodynamics. We have developed a diagnostic method to measure the velocity and thickness fields simultaneously in the soap film. The image represents a computer-processed snapshot of the flow field in the soap film perturbed by a comb.

Inside this issue

Customer Service Center . . . . . .(505) 665-4444 or cichelp@lanl.gov

Because of the wide variety of CIC computing services, numerous facilities are available to address your questions. If you are uncertain whom to call, you can always call the Customer Service Center (CSC). CSC consultants are trained to either answer your question or locate someone who can. To reach the appropriate consultant, dial 665-4444 and make your selection from the following choices:

Option 1: New user topics including e-mail, passwords, registration, and World Wide Web.

Option 2: Labwide Systems such as Travel, Time and Effort, and Purchase Cards.

Option 3: Scientific computing, storage systems, and networking.

Option 4: Classroom instruction and training.

Option 5: Desktop Consulting for PC and Macintosh software and network configurations.

Consulting Via E-Mail

Customer Service Center.....cichelp@lanl.gov

Scientific and engineering computing.....consult@lanl.gov

Administrative and business computing.....labwide@lanl.gov

Passwords and registration.....validate@lanl.gov

Macintosh computing.....Mac-help@lanl.gov

PC computing.....PC-help@lanl.gov

UNIX computing.....UNIX-help@lanl.gov

Other Useful Numbers

Advanced Computing Laboratory.....665-4530

Central Computing Facility.....667-4584

Network Operations Center.....noc@lanl.gov or 667-7423

Telephone Services Center.....667-3400

BITS CUSTOMER SURVEY

Dear BITS Subscriber,

With the long-time writer/editor of BITS, Mike Finney, returning to graduate school, the sponsors of BITS would like to take this opportunity to step back and look at our publication to see if it is meeting the needs of the readers.

We ask that you take a few minutes to consider the following questions. Please fill out this survey on the Web at <**http://surveyor.lanl.gov**>. However, if you do not have access to the Web, fill in the circles on this paper version, fold it with the return address out, tape it, and mail it back.

For survey information, contact Don Willerton and for technical problems, contact Leslie Morgeson.

Thank you for responding to this survey.
CIC-6 Customer Service
505-665-0424

cut along dashed line

Please indicate your predominant computing concern:
- ❍ ASCI (Advanced Strategic Computing Initiative) (LANL)
- ❍ ASCI (non-LANL)
- ❍ Desktop (local software, system admininstrator, etc.)
- ❍ Enterprise (travel, T&E, Administrative, etc.)
- ❍ non-ASCI, supercomputer (LANL)
- ❍ non-ASCI, supercomputer (non-LANL)

BITS should
- ❍ stay the way is is.
- ❍ change in format or content.
- ❍ be discontinued.
- ❍ I don't care.

If you answered "be discontinued" or "I don't care," please skip the rest of the survey, fold it, tape it, and mail it back.

How often do you read BITS?
- ❍ Never
- ❍ Rarely
- ❍ Some Issues
- ❍ Most
- ❍ Every Issue

What part(s) of BITS do you usually read?
- ❍ Technical articles
- ❍ Articles about people
- ❍ WWW at LANL
- ❍ Microcomputing news
- ❍ Updates to ICN procedures, etc.
- ❍ Class schedules
- ❍ Other, please specify _____

_____

How often would you want to access individual articles on-line?
- ❍ Never
- ❍ Rarely
- ❍ Sometimes
- ❍ Often
- ❍ Always

Please indicate your preference on a scale of 1-5 with 5 being the highest.

BITS should continue to report on all computing environments, including ASCI, supercomputing, desktop and networks.
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5

BITS should focus on ASCI only
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5

BITS should focus on the supercomputing environment, including ASCI
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5

BITS should focus on desktop workstations (Macs, PCs, UNIX boxes)
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5

BITS should focus on the computing infrastructure (networks, Information Architecture, Web)
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5

BITS should include information about people
❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5

How often would you like to receive BITS?

- ❍ Monthly
- ❍ Bi-Monthly
- ❍ Change to weekly newsletter format
- ❍ Change to "special issue" format: each issue focused on one topic; variable frequency
- ❍ Change to "continually updated" Website; information updated as needed; no longer a "publication"

Which BITS format(s) would you prefer to receive?

- ❍ Paper
- ❍ Website (HTML)
- ❍ Website with locally "print whole document" as an option
- ❍ Website with "print and send me the whole document" as an option
- ❍ Other, please specify _____

_____

If BITS were published only on the Web, indicate your preference for additional features:

- ❍ regular publication dates; no notification set to subscribers
- ❍ regular publication dates; e-mail notification sent to subscribers
- ❍ no regular publication dates; e-mail notification sent to subscribers
- ❍ no regular "publication"; Website is updated as information is new
- ❍ e-mail notification contains table of contents; subscriber requests and receives articles via e-mail
- ❍ no e-mail notification; Website has table of contents; subscriber requests and receives articles via e-mail

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CUSTOMER SERVICE GROUP (CIC-6)
LOS ALAMOS NATIONAL LABORATORY
PO BOX 1663
LOS ALAMOS NM 87544-9916

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General Comments

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Los Alamos
NATIONAL LABORATORY

Los Alamos, New Mexico 87545

Operated by the University of California for the US Department of Energy

The New Laboratory Forms System Is on the Web

The new Enterprise Information Applications (EIA) site offers Laboratory forms in PDF format that can be filled out on-line. The user can tab from field to field, enter data, and then print and save the form.

The software required to fill out these forms is available through the ESD.
• Acrobat Reader 3.01 with the 3.5 forms plug-in. This software is free, but does not allow you to save the form.
• Acrobat Exchange 3.01 with the 3.5 forms plug-in. This software costs $31.75 through ESD. With this software you can save the completed forms.

The PDF forms do not have database lookups at this time, but this feature will be added. JetForms will continue to be available at its current Web site but will be phased out as database look-ups are incorporated into the PDF forms.

To get started
1. Go to http://enterprise.lanl.gov/instruct.htm to download and install required software and get instructions.
2. Go to http://enterprise.lanl.gov/a-e.htm for the PDF fillable forms.

If you have any questions, contact Laboratory-wide Systems Support at 5-4444, option 2.

Special Web Download Instructions for Macintosh/Adobe Acrobat Exchange with Forms Fill-in Plug-in

Follow these steps during the installation:
1. Read and then PRINT these instructions. (You will need the serial number given below during installation.)
2. Download Exchange 3.01 (48.3MB).
3. Exchange will download an Adobe Acrobat VVP folder to a location of your choice on your hard drive. Note the name of the folder where you have placed this file. The download will take some time.
4. Exit your browser (Netscape or Internet Explorer).
5. Open the Adobe Acrobat VVP folder and then open the English folder, the Exch_Mac folder, and the Exchange folder. Double click on the Exchange 3.01 Installer that is in this folder. When prompted, double-click on Install to install Exchange.
6. Restart when prompted.
7. Return to the Adobe Acrobat VVP folder, double-click on the English folder, the Fillin_Mac folder, and then the Acrobat Fill-in Installer. When prompted, double-click on Install.
8. Restart when prompted.
9. Open your browser and go to http://enterprise.lanl.gov/a-e.htm. Select a form and open it. The form will be opened in Exchange. You will be prompted to register your software by providing your name, organization, and the serial # of the software.

The Serial Number is XNW400R7115580-218.

Special Web Download Instructions for Windows/Adobe Acrobat Exchange with Forms Fill-in Plug-in

Follow these steps during the installation:
1. Read and then PRINT these instructions. (You will need the serial number given below during installation.)
2. Download Exchange 3.01 (48.3MB).
3. Exchange will download an exchange.exe file to a location of your choice on your hard drive. Note the name of the folder where you have placed this file.
4. Exit your browser (Netscape or Internet Explorer).
5. Find the exchange.exe file on your hard drive and double-click on it. When presented with the WinZip Self-Extractor screen, click on Unzip, and an Exchange Folder will be created. Note the location of this folder, then click Close.
6. Open the Exchange folder and double-click on the Shortcut to Exchange Setup.exe to install Exchange. When presented with the Select Components screen, leave everything checked and click on Next.
7. When prompted, enter your name and the serial number of the software.

The Serial Number is XNW400R7115580-218.

8. Go back to the Exchange folder and double-click on the Shortcut to Fill-in Plug-in Setup.exe to install this plug-in.

Open your browser and go to http://enterprise.lanl.gov/a-e.htm. Select a form and see if you can fill it in, print it, and save it.

CIC-11 Strives for a Virtual Storage Environment

This article is one in a series of interviews BITS is conducting with CIC managers to get their views of the "big picture" as it relates to their work and the Laboratory mission. These people have also been asked to do a little forecasting as it applies to their business. BITS invites readers to join in the spirit of these interviews, treating the forecasts as a sort of informed speculation without holding anyone's "feet to the fire" to make the predictions come true.

"The Data Storage Systems Group is interested in providing a 'virtual' storage environment for the future," Group Leader John Blaylock says; "that is, an environment in which users do not have to be concerned with the details of the system and the data is managed using storage methods that are intuitive to the user. For instance," Blaylock explains, "end users should be able to manage data using certain metaphors and terminology appropriate to their own disciplines. A global climate modeler uses global climate objects, a nuclear weapons designer uses data sets of design information, and programmers use programming languages and APIs [application programming interfaces] that are natural to whatever programming model they're working in. Users shouldn't have to translate their terminology into data storage terminology to access their data."

Historically, the field of computing has moved from computer-centered to network-centered and now to the beginnings of data-centered models. From about the 1950s through the 1970s, computing was centered on mainframes and supercomputers. With the advent of relatively inexpensive, off-the-shelf components in the early 1980s, it evolved to distributed computing, centered on networks. The field of computing is now moving toward data-centered models. "Today we are on the threshold of data-centered computing; we can adapt this technology to deliver what the users really need: information retrieval and knowledge discovery," Blaylock explains. "Organizations realize that their competitive advantage arises from the information and knowledge that can be derived from their data. We need to manage data in such a way as to optimize this advantage. To do that we need innovative means of storing and retrieving data and metadata. Data-centered methods will help get us there."

Group CIC-11 is currently implementing such innovations and is studying future scientific data management systems in collaboration with its customer base—internal Laboratory groups and programs, especially the Accelerated Strategic Computing Initiative (ASCI), and external users, primarily the Defense Special Weapons Agency (DSWA) of the Department of Defense, and other laboratories as well. Making virtual storage possible will require strong partnerships between the group and its customers, data storage vendors, academia, and industry standards organizations.

Building the New Model

Over the next three to five years, efforts in two major areas will help CIC-11 make virtual data storage a reality: dramatic improvements in data storage infrastructure and just as dramatic improvements in data management. In the old model, archival storage, backups, data sharing, and data exchange were all-in-one—the old Common File System (CFS). In the new model these systems are separate: CFS and HPSS (High Performance Storage System) handle archival storage, ADSM (Adstar Distributed Storage Manager) handles backups, NFS (Network File System) and DFS (Distributed File System) handle data sharing, and IES (Import/Export Service) and the Mercury service handle data exchange.

The separate components of the data storage infrastructure—disks, tape transports, automatic tape libraries, etc.—will be connected via a common data storage network. Such connectivity enables more efficient data management. The connectivity improvements will be accomplished under a common data storage infrastructure with centralized administration, probably Web-based. The new infrastructure will use inexpensive, off-the-shelf components. Within this infrastructure, when one storage component fails, another automatically picks up the task. The concept of load-balancing, that is, the ability to direct data to an appropriate inactive peripheral machine—disk, tape transport, automatic tape library—will also enhance performance of the data storage system.

While enhanced performance of computers is gained through the scale-up of solid-state devices such as CPUs and memory, performance scale-up of data storage systems is more difficult. Storage-system components—disks, tapes, etc.—are electromechanical devices consisting of rotating spindles subject to centrifugal forces and friction. Any attempt to increase the rotational speed or areal density leads to immediate problems with mechanical stress and excess heat. There are also more exotic problems associated with enhancing these devices. An example is the so-called "super-paramagnetic effect," whereby the thermal activity in the media induces a local magnetic field strong enough to corrupt the stored data. The data storage community is working to solve these problems.

In parallel with the infrastructure scale-up, the worldwide data storage community is developing innovative software to create the virtual storage environment. In this "virtual" world users will not have to know the details of the data storage systems, for instance, the file storage structure or the locations of data. The layers of software (see Figure 1) between the user and the storage network will be implemented in an object-oriented framework. Such software will continue to become more feature-laden. CIC-11, working with the larger data storage community, will implement sublayers to allow data management to accomplish "transparent" interactions between the user's data and the storage of that data. The interaction between the data management and storage management layers is where the hard work needs to be done. The data management layer is the key; it will translate the user's request in such a way that the storage layer can understand it. The data management layer and the storage layer then exchange information for more efficient operation. For example, the storage layer can query the data management layer to find out how fast the request needs to be processed and use that information to place the data in the queue for storage or retrieval.

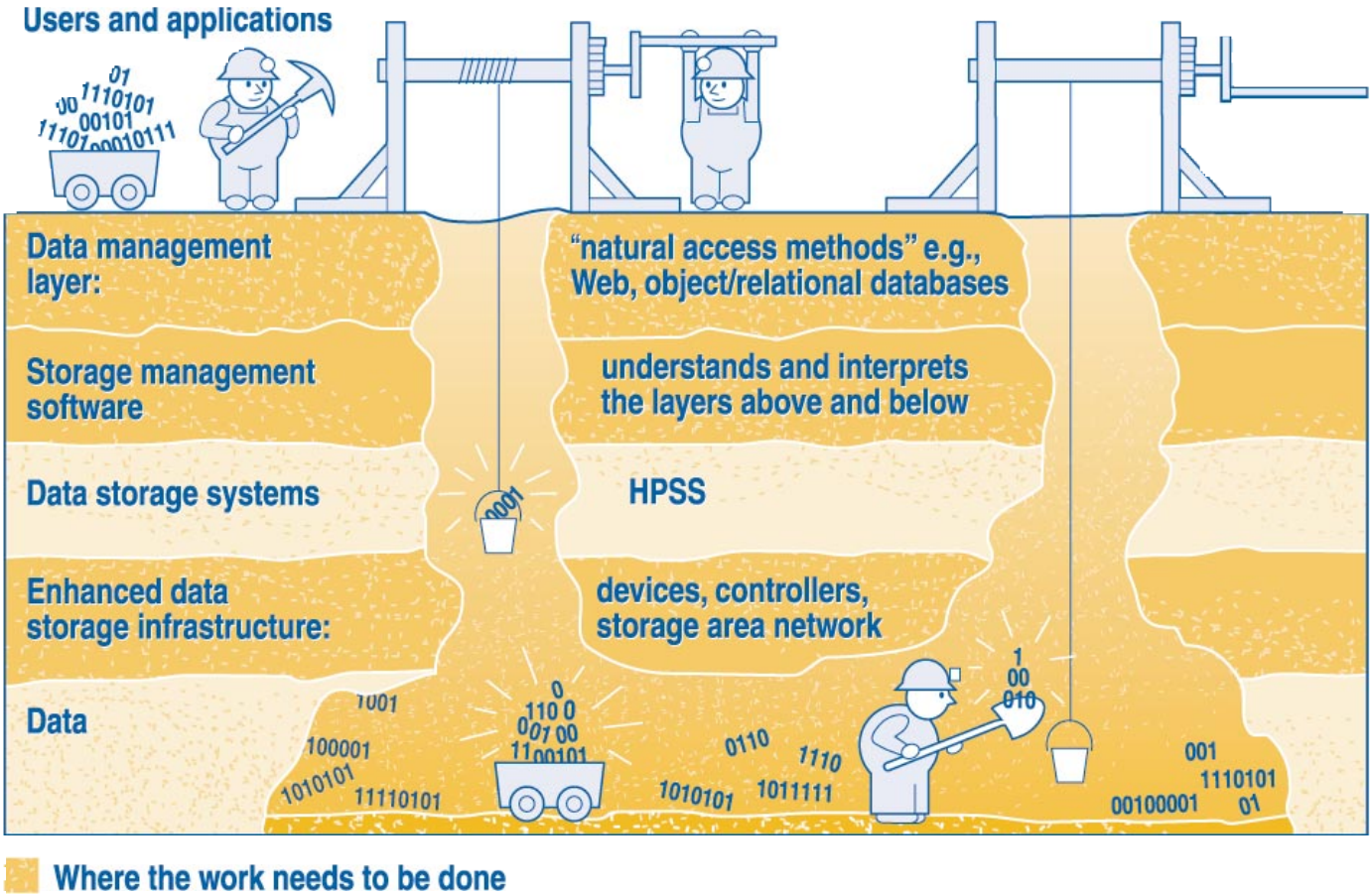


Figure 1. To enable a "virtual" storage environment, the data storage community, including CIC-11, will develop software that allows users to access their data without having to know anything about the file storage structure. The users then can more efficiently mine their data for its real value: the knowledge it contains.

LANL's Contribution

The Laboratory's contribution to this industry-wide challenge will be to target a set of users or applications on which to implement new data storage technology. CIC-11 group members will also continue to partner with vendors in the development of industry standards for data storage.

In this context one obvious target is ASCI, tasked with verifying and validating nuclear weapon designs. To do so, ASCI must be able to combine 50 years of weapon design information and to model the aging of nuclear materials. ASCI's needs will consume most of the Laboratory's computing and data storage capabilities for the foreseeable future. ASCI represents a relatively small portion of CIC-11's customers, but it will use the bulk of the group's storage resources.

Blaylock says that the innovations in data storage infrastructure and data management would happen even without ASCI, but ASCI's tremendous needs for bandwidth and library capacity will accelerate the trend in the next few years. Two leaps in technology may help make the performance improvements necessary to serve ASCI's needs: (1) CIC-11 is following closely the commercial development of high-performance optical tape and disks and plans to use them if they become available; (2) the group also plans to exploit concurrency by moving data files in pieces and laying the data down in parallel via multilevel "striping" of the disks and tapes (either optical or magnetic). Today, data can be stored at the rate of about 20 megabytes per second on HPSS as a file is broken into two segments and moved to two tapes. In the future, when data comes in over multiple HIPPI (high-performance parallel interface) channels at 100 megabytes/sec per channel, it will be broken into several pieces, and each piece will again be broken into 8, 16, 64, or many more stripes, for multilevel striping. Extra "parity" tapes will be used, so that if data is lost from a stripe, it can be recovered. Development of this technology will require partnerships with vendors.

In conclusion Blaylock observes, " 'Virtual storage' is what's happening in the computing world today, and the Laboratory needs to play a major role in it. Some of the advances such as optical tape may be on the outside edge of developing technology, but CIC-11 will continue to serve its customers by staying on top of technological advances and any innovations in the way data is stored and managed."

Blaylock has worked for the Laboratory for twenty years, the first ten of which were spent in TD and X Divisions doing code development. He joined C Division in 1988 as leader of the Programming Environments Section of Group C-10, where he and his colleagues developed and maintained the run-time software (compilers, loaders, debuggers, input/output libraries, etc.) for the Cray supercomputers. During this time Blaylock also served as the coordinator of the UNICOS Migration Project that led the Laboratory's transition from the CTSS (Cray Time-Sharing System) to the UNIX environment. For four years he was team leader of the Systems Environments Team in CIC-2 and later the team leader of the Cluster Project in Group CIC-7. Blaylock has been in his current position for three years and finds it both intellectually stimulating and professionally challenging. When he is not working, he can be found skiing in the winter, mountain biking in the summer, and reading fiction year round.

Ann Mauzy, mauzy@lanl.gov, (505) 667-5387
Communication Arts and Services (CIC-1)

Easing the Traffic Jam: Improving Web Performance

1993: The "good old days."
The old NCSA Mosaic prereleases were a breakthrough. We could actually see in-line images! Of course, my computer would hang and crash, and I had this HyperGopher-based habit of double-clicking links, which sometimes led to jumping straight past the page I was aiming for and off into someplace it linked to. Our character set was limited.Layout consisted of paragraphs, lists, and <PRE>-formatted fixed-character-width tables.

But it was fast.

HTTP traffic--the protocol of the Web--was a fraction of what it has since become. Not only were there not as many people using the Web, but we were also restricted by necessity to lightweight pages. So in spite of lower-bandwidth networks and less powerful browsers, pages in general transferred faster and loaded faster.

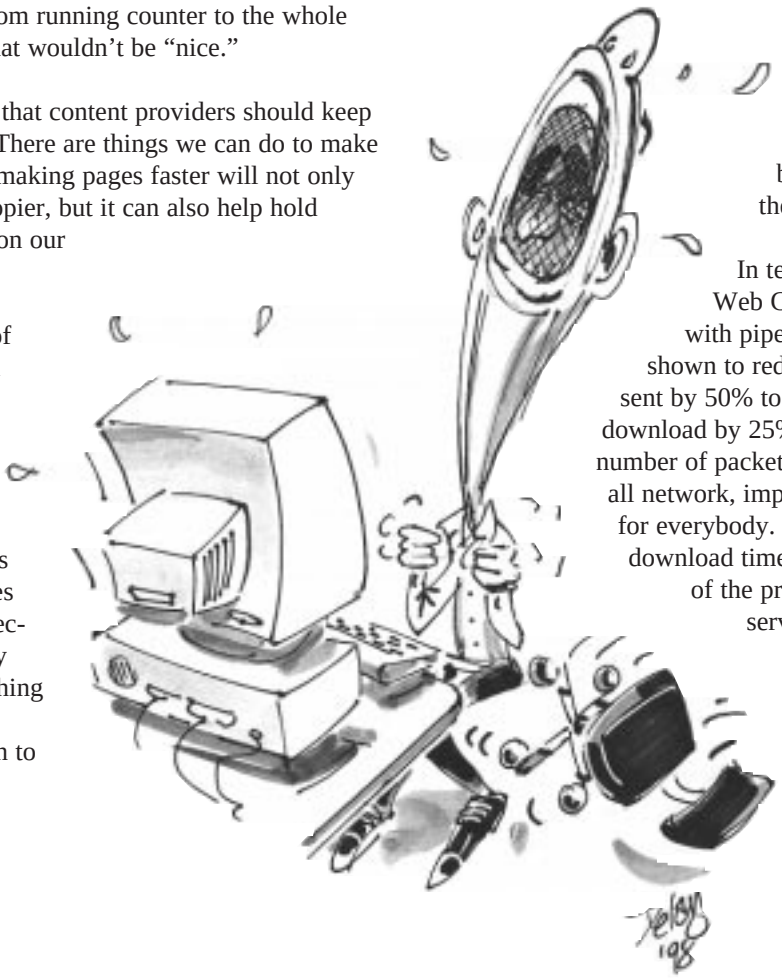
Now, I'm not about to argue that we should start throwing people off the Web so that performance will improve for the rest of us. Aside from running counter to the whole purpose of the Web, that wouldn't be "nice."

I will suggest, though, that content providers should keep performance in mind. There are things we can do to make pages load faster, and making pages faster will not only make our audience happier, but it can also help hold down the overall load on our networks.

As usual, the amount of effort we should spend optimizing content for performance depends in part on who the audience for the page will be. If it's a handful of co-workers with powerful machines and fast network connections, and they are only going to look at something a couple of times, then there's not much reason to worry about finding, for example, the ideal compression. If, however, we're putting up content for a diverse audience with widely varying machines and connections, then there are clearer benefits to optimizing the content so that it will be load as quickly and efficiently as possible.

Consider HTTP/1.1
HTTP, the HyperText Transfer Protocol, has been under constant development throughout the 1990s. In general, HTTP communicates through TCP, the Transmission Control Protocol, and sends a separate request for each piece of content to transfer. For example, in loading a typical Web page, the browser will send one request for the page itself, a separate request for the background image, and additional requests for each image, sound, applet, etc., embedded within the page.

HTTP/1.1, the current "near-production" version of the protocol, offers a number of improvements over its predecessor, HTTP/1.0. "Pipelining," for example, allows a number of separate requests to be bundled together into a single package, thereby making more efficient use of the underlying TCP protocol. Compression further improves performance by reducing the overall size of the content that is sent.



In tests run by the World Wide Web Consortium (W3C), HTTP/1.1 with pipelining and compression was shown to reduce the number of "packets" sent by 50% to 90% and the overall time to download by 25% to 65%. The reduction in the number of packets reduces the load on the overall network, improving network performance for everybody. The reduction in the actual download time is somewhat less, as a result of the processing time required for the server and client to interpret the more complex HTTP/1.1 transmission (e.g., compress and decompress the content).

HTTP/1.1 is largely (if not always completely) implemented by up-to-date browsers (e.g., Netscape Navigator and Microsoft Internet Explorer) and by a wide range of up-to-date servers (e.g., Apache, Lotus Domino, Netscape Enterprise Server, Microsoft Internet Information Server). It is not, however, implemented by some of the older servers that still remain popular, such as NCSA HTTPd.

Hence, if you are a server administrator running one of the older HTTP/1.0 servers, you might consider migrating to newer software in order to improve network performance. Similarly, if you are a content provider on an older server, you might ask your server administrator to consider the upgrade.

For its part, the Information Architecture Team, which always tends to be conservative, is currently considering upgrading its Laboratory standard HTTP from 1.0 to 1.1. At the time this article is published, that proposed upgrade will most likely be out as a Request for Comment for Laboratory-wide input. If that is the case, your comments would certainly be welcome. (IA RFCs are available from the RFCs page at <http://www.lanl.gov/projects/ia-lanl/rfcs/>, with access restricted to Laboratory machines.)

Balance Client-Side and Server-Side Scripting

For simple tasks, performance can frequently be improved by moving the processing over to the client side. The script to perform the task needs to be transferred to the client, which adds somewhat to network traffic, but once it's transferred, no additional calls to the server are needed, which reduces network traffic.

Server-side processing is generally better for more complex tasks that involve large volumes of data or that otherwise need access to server files. The request to process and the process results need to be sent across the network, adding to traffic, but the request and results can be smaller than the overall volume of information that would need to be sent for the client to perform the task itself.

A few examples might illustrate:

- "Image maps" are large images that link to different places when the user clicks on different areas of the image. Both client-side and server-side image maps are now widely supported. Server-side image maps, however, require the server to open and interpret an additional file, thereby adding to server processing time, while the client-side image maps allow the browser to directly call the target address. Hence, unless the target addresses are unusually long (such as very lengthy database queries), client-side image maps are generally preferable.

Note: As further discussed below, single image maps are generally preferable to multiple linked images. Also, whenever using images for navigation, remember to provide descriptions with the ALT attribute so that people who cannot see the images can still follow the links.

- One of the "gimmicks" on our Year 2000 site is a little clock that counts down the number of seconds remaining until midnight, December 31, 1999. Because this displays a new result every second, it is an extreme example of what would be a very poor choice for a server-side script. By using JavaScript on the client-side, we can send the lightweight script just once and let all of the rest of the processing occur on the client.

- An extreme example of a very poor choice for a client-side script would be any of the major search engines such as AltaVista or InfoSeek. The volume of data they would need to transfer in order to perform the search is simply prohibitive.

- A less extreme example of a script that needs to be run on the server is the comment form that the IA includes with each of its RFCs. When a user submits comments through the form, seven different files are opened and written to on the server, both sending out e-mail to our distribution lists and updating our on-line archives. Since this is done on the server side, it can all be initiated with a single POST from the client.

Client-side processing continues to evolve with the introduction of ever newer flavors of Java, JavaScript, and "Dynamic HTML." Unfortunately, however, the shared ground of adherence to international standards has been emerging somewhat more slowly. For example, both Netscape and Microsoft were involved in the development of "ECMAScript" (the "standard" version of JavaScript from the European Computer Manufacturers Association). However, ECMAScript-compliant languages are still in their early stages, with Microsoft announcing support

in JScript 3.0 (Internet Explorer 4, October 1997) and Netscape announcing support in JavaScript 1.3 (Navigator 4.5, currently in preview release). (Note we have not independently tested these languages yet.)

The upshot of all of this is that we are left needing to test our client-side scripts under multiple browsers and versions to ensure that they will work for whoever our projected audience is. There is more we can do today than we could last year, and much of what we can do does improve network congestion and page performance, but the ground still isn't as stable as we might like.

Image Tips

Although the overall situation has improved markedly over the past few years, there are still a number of cases where JPEG (Joint Photographers Expert Group) and GIF (Graphical Image Format) are incorrectly chosen. To review, for photorealistic images (e.g., photographs, continuous color images), JPEG will generally yield higher quality at a lower file size. For line art (e.g., palette images, lettering), GIF is generally better in terms of both quality and file size. When you see smudgy lettering in an image, that's a sign of JPEG being used when GIF would be better. When you see spotty photographs, that's a sign of GIF being incorrectly chosen.

W3C's PNG (Portable Network Graphics) is rapidly gaining support and may be viable for in-line use within the next year. It is already supported in-line by Internet Explorer 4 and Navigator 4.04, though there appear to be some limitations in the implementation. The IA will continue to monitor its emergence, and I plan to write a BITS article addressing its effective use as soon as its support has stabilized.

In the meantime, the trick to optimizing a JPEG image is to save it at various compression ratios and then look at the results. Sometimes anything more than about 5% compression can lead to unacceptably poor image quality. At other times, compressions as high as 75% prove acceptable.

For GIF images, reduce the palette to all that is needed. In a quick test I just ran, I was able to reduce file size by 70% simply by reducing the number of colors in the palette from 256 to 16--without a noticeable loss of image quality in the particular example. In other cases, of course, the additional colors are needed, so reducing the palette would be unacceptable.

For all image formats, a single larger image is generally better than multiple smaller images (as noted in the discussion of image maps, above). One reason is that the larger image can be sent with a single HTTP call and response, reducing network traffic and download time. Furthermore, each image format has a header section, and a single larger image only requires one header, while the multiple smaller images will take up more space with their repeated headers. We can expect this effect to be particularly pronounced with PNG, as its headers are somewhat larger, but its compressions are particularly powerful.

Of course, multiple images cannot be combined into a single image if they are in different formats or need to "float" to align separately with text. When they're the same format and adjacent, though, combining them generally offers performance benefits.

For More Information

For more information about the HTTP protocol, please see IA-5606: Standard HyperText Transfer Protocol (HTTP) at <http://www.lanl.gov/projects/ia/stds/ia560611.html>. For more information about JavaScript, please see the two BITS articles on "JavaScript Observations and Tips" (March and May 1997). For more information on image formats, please see the two BITS articles on "Images on the Web" (August and September 1996) and the IA White Paper IA-6801: Electronic Image Formats and Compression Algorithms at <http://www.lanl.gov/projects/ia/stds/ia680111.html>.

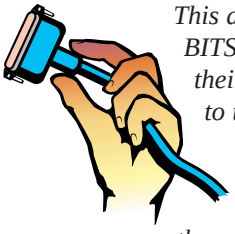
For more information about the IA in general, please visit our project home page at <http://www.lanl.gov/projects/ia/>. If you need printed or e-mail copies of any of the IA materials, please contact me via the information given below.

Tad Lane, CIC-1, 505-667-0886, tad@lanl.gov,
<http://www.lanl.gov/projects/ia/staff/tad.html>

Information Architecture Standards Editor,
<http://www.lanl.gov/projects/ia/>

IA Internet/WWW Subject Area Champion,
<http://www.lanl.gov/projects/ia-lanl/area/web/>

CIC-5 Increases Bandwidth, Reduces Latency



This article is one in a series of interviews BITS is conducting with CIC managers to get their views of the "big picture" as it relates to their work and the Laboratory mission. These people have also been asked to do a little forecasting as it applies to their business. BITS invites readers to join in the spirit of these interviews, treating the forecasts as a sort of informed speculation without holding anyone's "feet to the fire" to make the predictions come true.

Like any network services provider, the CIC-5 Network Engineering Group endeavors to optimize network reliability, stability, bandwidth, latency, innovation, and cost—parameters that contribute to customer satisfaction. In fact, Group Leader Chris Kemper says, "A large measure of customer satisfaction in this business is invisibility—people getting their jobs done without concern for the network." CIC-5 is responsible for the Laboratory network infrastructure from the "backbone" to the user's wall jack.

Use of the network is growing exponentially, Kemper says. "The open network backbone traffic is doubling every 12 months, and we can see this trend is accelerating. This has led CIC Division to concentrate on providing more and more bandwidth Labwide." Through the LANLnet project, supported with Laboratory G&A funds, the goals of getting everyone at the Lab connected to the network and providing fiber optic cables to every building are nearly complete. The goal of providing "Cat-5" unshielded twisted-pair cabling to every office for the network is about halfway done. Kemper says, "Cat-5 wiring will easily support 100 megabits per second to the office, which should be enough for most people for the time being."

As Kemper points out, "Network Nirvana includes a wiring infrastructure that allows us to keep up with technology and user needs by simply changing the electronics. It will take a couple more years, and it won't be cheap to finish wiring the Lab with Cat-5 everywhere." Wiring the Lab is labor-intensive. On the other hand, like computers, calculators and other consumer electronics, pricing on network electronics tends to start high and drop relatively quickly. Kemper says, "If we time it right, we can make significant upgrades to the network electronics for pretty reasonable costs."

But there's network technology on the market right now that goes beyond the capabilities of the twisted-pair cable to provide fiber-optic cable to the office. Some organizations around the Lab are expressing interest in a gigabit ethernet, the next step on the road from the present 10 to 100 megabits per second to 1,000 megabits per second to the office. Kemper says, "We're in the process of evaluating gigabit ethernet products now, and we expect introduce the technology to the production network by mid to late summer."

Kemper adds, "The way people are using the network is rapidly changing as well." The old axiom that 80% of network traffic was local and 20% crossed the backbone has changed in many cases, mostly as a result of the ways people use the Web. Trends affecting bandwidth utilization include the use of "real audio and video" where people access training, live conferences, and news through the Web in much the same way they would use a TV or radio. Also, the possibility of making telephone calls through the network (voice over IP) in the future will be putting greater and greater demands on the network.

Of course, the Advanced Strategic Computing Initiative (ASCI) that influences so much of the Laboratory's strategic planning is influencing the future of the network here as well. Along with its "TeraOp" processing speeds and tera- and petabyte file size requirements for predictive modeling and simulation, the program requires commensurate bandwidth increases and latency decreases. In the next year, the Integrated Computing Network (ICN) backbone will start migrating from HIPPI-800 (High Performance Parallel Interface, 800 megabits per second) to the new HIPPI-6400 (6.4 gigabits per second) technology. Kemper says, "HIPPI-800 was invented in CIC-5, and the group is taking the lead role in the development of HIPPI-6400 as well." The group's philosophy on very high speed network and protocol technology is to lead the development of ANSI (American National Standards Institute) standards that any computer manufacturer can design to. Group members serve on (and chair) ANSI committees, work with industry, and develop prototype circuits. Kemper adds, "HIPPI-6400 is a huge improvement over the older 800 megabit standard—not just in speed but also in transmission error control." The older standard relied upon higher layers in the protocol stack to do error detection and retransmission. HIPPI-6400 takes care of all of this in hardware. Several computer manufacturers, including SGI/Cray, DEC, and HP, have designed or are designing HIPPI-6400-compliant hardware.

The ASCI program is having a big effect on the Lab's connection to the Internet as well. The need to transfer huge files over the Internet between the Lab and Livermore and Sandia recently drove our connection speed from 45 megabits per second to 155 megabits per second. Increasing use of the huge ASCI computers (the SGI/Cray machines at LANL and the IBM machines at LLNL) by scientists and engineers at

each lab is expected to require increasing the rate again next year to 622 megabits per second. With the expected arrival of the 30-TeraOp machine at Los Alamos in 2001, this rate could well jump to 2.5 gigabits per second. Kemper says, "It will be a challenge to see if we can achieve these data rates without significantly increasing the national debt. Right now, the fastest and most cost-effective network technology is a truckload of magnetic tapes!"

Further Challenges

In addition to technology challenges, CIC-5 is increasing emphasis in network security. "The Lab is probed several times each week by potential hackers. There are some sophisticated tool kits available on the Web that can enable a network novice to launch some pretty subtle attacks. The tool kits include the means for covering tracks such that it's very hard to pinpoint the actual source. And typically, hackers launch their attacks from different places on the Internet where they've already compromised a computer. The newspapers are full of stories of hackers breaking into commercial or government networks." Kemper says.

One step that will help network security is the division of the network into open (green) and protected-open (blue) partitions. The protected-open network will be similar to the "administrative" partition in that network traffic will be much more tightly controlled. Kemper says, "The rules for accessing the green partition from the Internet will be to allow everything but what we have identified as bad. On the other hand, the rules for accessing the blue partition will be based on allowing only what we believe to be good. Sandia operates this way today, and Livermore is just starting its network partitioning effort." The goal is for most Laboratory employees to eventually have their workstations in the blue partition. Kemper adds, "People working in the blue partition won't notice much of a difference in day-to-day routine. People accessing the blue partition from home or off-site may see stronger authentication requirements. For example, clear text passwords will not be allowed in favor of smartcards or various types of secure or encrypted sessions (such as Kerberos or SSH)."

As with any organization, the success of CIC-5 is mostly a function of its people—their knowledge and dedication as well as their relationship with their customers. Kemper says, "I'm very fortunate to have this group of people. They are tops in the field and they all take 24-hour-per-day network operation and reliability very seriously." Running classified and unclassified production networks supporting over 16,000 network nodes on a 24-hour, 365-day basis takes a lot of dedication. Kemper adds, "You'll see people in the group working lots of nights and weekends to keep the network and network services up-to-date and running smoothly."

The group believes in gathering customer requirements and making changes to the network only after comprehensive testing. Kemper says, "We sometimes miss something, or occasionally a customer will make a change in his/her network that will cause a network outage. If our people or net-

work management systems don't discover the problem right away, we are fortunate in having a network managers users group (NMUG) that doesn't hesitate to call the situation to our attention or to suggest corrective actions." Kemper adds, "There are lots of people around the Laboratory with a great deal of networking knowledge and experience. We appreciate their help, and our goal is for their efforts and our efforts to be complementary."

Labwide Standards

The Information Architecture (IA) project is a great help to the group in gaining Labwide consensus on network needs, user preferences, and standards. Any major change to the unclassified network is always run through the IA request for comments (RFC) or request for help (RFH) process.

Kemper has been at the Lab for 10 years. He started as a communications engineer and later became group leader of the Telecommunications Group (CIC-4). He has been the CIC-5 group leader for the past three years and was recently named acting deputy division leader. He has also worked in industry as a circuit designer and a software developer. He has two daughters and likes to spend his free time designing and building audio gear.

Ann Mauzy, mauzy@lanl.gov, (505) 667-5387
Communication Arts and Services (CIC-1)

ASCI Documentation On-line!

In July, a special team in CIC produced a hard copy document with a series of annotated examples using the "ASCI at LANL" platforms. This document is now fully implemented on the web. Using this address <http://www.lanl.gov/asci/bluemtn/examples> or by going to the Open Blue Mountain Home Page, selecting Getting Started, and then selecting "Annotated Examples and Technical Encyclopedia," you'll see a navigation page that presents the different examples, notes, and an associated encyclopedia. You can go through the whole document in sequential fashion, or you can go to each example. Selecting an even finer table of contents, you can go to sections individually. Within the examples and encyclopedia, there are links to other sources for more information.

The navigation page also allows you to print examples separately or gather them together and print several at one time. The team is now creating a procedure for updating the examples and notes rapidly and developing a print mechanism that controls pagination and margins.

Please give us your feedback on this documentation! Send comments to consult@lanl.gov.

Research Library Training

Classes are free but preregistration is appreciated. Register by e-mail to library@lanl.gov or phone the Library Service Desk at 7-5809. Please include your name, Z#, and the date/title of the session in your message. Library staff can also arrange special classes or schedule training at your site.

Date	Time	Subject Matter
9/2	1:00-1:30	Research Library Tour
9/9	1:00-1:30	Research Library Tour
9/10	1:00-1:30	SciSearch© at LANL
9/15	2:00-2:30	Introduction to Electronic Library Resources
9/16	1:00-1:30	Research Library Tour
9/17	11:00-11:30	MELVYL (U of CA specialized databases)
9/23	1:00-1:30	Research Library Tour
9/23	1:00-1:30	Finding Addresses and Phone Numbers on the WWW
9/24	2:00-4:00	InfoSurfing: Basic Web Searching Strategies
9/28	1:00-1:30	What the Report Collection Can Do for You
9/29	1:00-1:30	DOE Energy Database
10/7	10:00-10:30	GeoRef© on the Web
10/7	1:00-1:30	Research Library Tour
10/21	1:00-1:30	Research Library Tour
10/21	1:00-1:30	Finding Addresses and Phone Numbers on the WWW
10/22	2:00-4:00	InfoSurfing: Basic Web Searching Strategies
10/27	1:00-1:30	SciSearch© Alerting Service
10/29	11:00-11:30	Environmental Web Resources

Computer Training

The Customer Service Group (CIC-6) offers technical computer training (Enterprise Information Applications, communications, office administration, and Web authoring) and advanced technical computer training (programming languages, system administration, and advanced applications). To register for a course access our Web page at

http://www.lanl.gov/cic/cic6/training.html

Or from the LANL home page select the links Training, Computer. For further information about technical computer training call (505) 667-9559 and for advanced technical computer training call (505) 667-9399.

Communications
- Eudora 4.02
- Lotus Notes 4.5x
- Meeting Maker 5.0.3

Office Skills 2000
- Office Skills 2000 LANL Computing
- Office Skills 2000 Professional Development

Web Authoring and Browsing
- FrontPage 98
- HTML Basics
- HTML Intermediate
- Netscape 4.0

Coming Soon
- Directory Information System (DIS) Web
- Procurement Desktop
- Recharge

Enterprise Information Applications (EIA)
- Date Warehouse - Basics
- Date Warehouse EDS Reports
- EDS Basics
- EDS Training Plans
- Foreign Travel GUI
- Infomaker
- Invoice Approval System
- Purchase Card System
- Time & Effort GUI
- Travel GUI
- Web JIT

Other EIA Courses
- Financial Management Information System (FMIS)
- Property Accounting, Inventory and Reporting System (PAIRS)
- Signature Authority System (SAS)
- Secretarial/Contract Services (SE)
- Salary Review System (SRS)
- Directory Information System (DIS)
- Automated Chemical Information System (ACIS)

Application Training
- Advanced WWW Development
- FrameMaker Basic & Advanced
- Foundations of IDL Programming
- IDL 5.0 Graphic Object Workshop
- Netscape Servers for Intranet Development
- Origin2000 Applications Programming and Optimization
- Running on the ASCI Blue Mountain Systems
- Sendmail/Managing Internet Mail
- C++ and the Unified Modeling Language
- Sybase Performance and Tuning for System 11
- Sybase SQL Server Administration
- Unix (Beginning)
- Unix (Advanced)
- Visual Basic 5.0 Fundamentals
- Visual C++ Windows Programming

Programming Training
- C Programming (Beginning)
- C Programming (Advanced)
- C++ for Experienced C Programmers
- ANSI/ISO C++ Programming Clinic (Advanced C++)
- Java Programming
- Java Programming Workshop
- Distributed Programming With Java
- Object Technology: A Management Overview
- Object-Oriented Analysis and Design
- Perl Programming
- C-Shell Programming

System Administration Training
- SGI System Administration (Beginning)
- SGI System Administration (Advanced)
- SGI Network Administration
- SGI Performance Evaluation and System Tuning
- Solaris 2.X System Administration
- Solaris 2.X Network Administration
- Solaris 2.X Server Administration
- Unix and Windows NT Integration
- Windows NT Workstation and Server
- Windows NT Optimization and Troubleshooting
- Windows NT Security

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INTEGRATED COMPUTING NETWORK (ICN) VALIDATION REQUEST

Instructions:

(1) Complete all parts of this form that apply to you. Please take note of the "Special Requirements" section and complete any applicable parts.
(2) Manager (Group Leader or above) authorization and signature are required for all validation requests.
(3) Before submitting this request, ensure that your Employee Information System (EIS) information is current.
(4) Once completed, either mail this request to the Password Office at MS-B251, fax it to (505) 667-9617, or, if you are cleared, handcarry it to TA-3, SM-200, Room 257.

If you have **questions** call (505) 665-1805 or send e-mail to validate@lanl.gov

Owner Information

Z-Number (if you have one)			Name (last, first, middle initial)
LANL Group	Phone Number	LANL Mail Stop	Citizenship (Foreign National **see** "Special Requirements-Foreign National")

Check LANL affiliation:

- ☐ LANL employee
- ☐ Contractor _____ (specify contract company)
- ☐ External user_____ (specify employer)
- ☐ Other (specify)_____

Send password / smartcard to:

☐ Mail Stop or ☐ Mail to address indicated below

Name / Organization
Address
City, State, Zip Code

Access

Check access method and needed partitions:

Access method: ☐ ICN Password ☐ Smartcard ☐ Both

☐ **Open** partition (e.g., open machines, or for dial up access)

☐ **Administrative** partition (e.g., Travel, Data Warehouse, IA [BUCS, Stores], IB [EIS, FMIS, PAIRS])
If you are not a cleared LANL employee, see required steps in section "Special Requirements-Administrative Partition".

☐ **Secure** partition (i.e., secure machines)
A Q-clearance is required for secure access. After obtaining Manager signature for Secure access, handcarry this form to the Password Office to obtain your Secure account.

I certify this person does require **secure** access:

_____ _____
Manager Signature (Group Leader or above) Date

Password Office Use Only

New ☐ Change ☐	Clearance Status	Processed	Lv	Smartcard Serial #
Comments:				

Form 1646 (3/95) Supersedes previous versions (rev. 4/97).

Continue

Special Requirements

Administrative Partition
Lab-Wide Systems (e.g., Travel, Data Warehouse, IA [BUCS, Stores], IB [EIS, FMIS, PAIRS])

☐ Under 18 years of age

If you need to access Administrative systems, your Group Leader must provide a memo accepting responsibility for your actions and justifying your need for access. This memo is to accompany all forms taken to the security briefing (see "Contractor or Non-Cleared") section below. You may not access the Secure Partition.

☐ Contractor or Non-Cleared

Phone (505) 665-4444 (option #2) to obtain Access Authorization packet.

Phone (505) 667-9153 to schedule a security briefing.

Bring all forms including this ICN Validation Request to the security briefing for approval.

CIC-6 Security Briefing Approval Signature	Date

☐ Foreign National

Attach a copy of Form 982 (REQUEST FOR UNCLASSIFIED VISIT OR ASSIGNMENT BY A FOREIGN NATIONAL) with all approval signatures. Be sure Box #11 of Form 982 is completed. If you are not a visitor/assignee under a LANL/DOE approved Visit / Assignment Request, attach written justification from your host Group Leader or Division Director describing your need to access the ICN.

Authorization (required)

Print Manager Name (Group Leader or above)	Manager Z-Number	Group
Manager Signature (Group Leader or above)	**Mail Stop**	**Date**

If you are NOT a LANL employee you must have a LANL contact and obtain the contact's signature in addition to the contact's manager's signature.

LANL contact: Read the following and sign below.

By signing this form I affirm that I understand and accept the following:

a. I am a regular Laboratory employee.

b. I am responsible for forwarding password reauthorizations and verifying annual account reauthorizations for this user.

c. I am responsible for notifying the Password Office within 10 days of changes in my status.

d. I am responsible for notifying the Password Office immediately of changes in this user's status (termination, end of contract, etc.).

Print LANL Contact Name	Contact Z-Number	Phone Number	Group
LANL Contact Signature		**Mail Stop**	**Date**

NOTE: All Laboratory computers, computing systems, and their associated communication systems are for official business only. By completing this validation request and signing for a password and/or smartcard, you agree not to misuse the ICN. The Laboratory has the responsibility and authority to perodically audit user files.

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